PDS ANALYST'S NOTEBOOK: ENRICHING PLANETARY DATA ARCHIVES BY INTEGRATING MISSION DATA AND DOCUMENTS. T. C. Stein[1], R. E. Arvidson[2], T. L. Heet[3], and J. Wang[4], [1]Washington University in St. Louis, 1 Brookings Drive, CB 1169, St. Louis, MO 63130, tstein@wustl.edu, [2]arvidson@wunder.wustl.edu, [3]tlheet@wunder.wustl.edu, [4]wang@wunder.wustl.edu

Introduction: The PDS Analyst's Notebook (http://an.rsl.wustl.edu) provides access to the Mars Exploration Rover (MER) [1], Mars Phoenix Lander [2], and Lunar Apollo surface mission data archives. In addition, a Notebook is being developed for the LCROSS mission.

Mars mission data are enriched by integrating sequence information, engineering and science data, observation planning and targeting, and documentation into web-accessible pages to facilitate "mission replay." This provides context needed by scientists to understand observations made by these nondeterministic surface missions. Historical data from the Apollo missions are presented along with associated documentation and links to external holdings.

Populating the Notebook: Each Notebook contains data, documentation, and support files for a given mission. For MER and Phoenix, inputs are incorporated on a daily basis into a science team version of the Notebook. The public version of the Analyst's Notebook is comprised of peer-reviewed, released data and is updated coincident with PDS data releases as defined in mission archive plans.

Data. The MER and Phoenix Notebooks contain publicly released, peer-reviewed PDS archives from all science instruments. The data are provided by the instrument teams and are supported by documentation describing data format, content, and calibration.

Both Operations Products Generation Subsystem (OPGS) and Science data products are included in the MER and Phoenix Notebooks. The OPGS versions were generated to support mission planning and operations on a daily basis. They are geared toward researchers working on machine vision and engineering operations. Science versions of observations from some instruments are provided for those interested in radiometric and photometric analyses.

Apollo data are organized by mission, instrument, and station. Data are added to the Notebook as they are restored from original tapes, reports, and microfilm. Where data have not been restored the user is redirected to external data providers such as the National Space Science Data Center (NSSDC).

Documents. Several types of documents are included in the Notebook. Mars Notebooks contain data set documentation and sol (i.e., Mars day) documents. The sol documents are the mission manager and documentarian reports that provide a view into science operations—insight into why and how particular observations were made. The reports have not been edited except for grammar and spelling, and to remove spacecraft and instrument sensitive materials.

Data set documents contain detailed information regarding the mission, spacecraft, instruments, and data formats.

The Apollo Notebook contains references to preliminary science reports, overviews, and catalogs for experiments and collected samples.

Science Plans. For the MER and Phoenix Notebooks, observation planning and targeting information is extracted from each sol's tactical science plan. This information includes instrument settings such as filters used and sensors selected, as well as observation parameters such as distance to target.

Navigating through the Notebook: A number of methods allow user access to the Notebook contents. The feature set of each Notebook varies, depending on the types of input available.

Mission Summaries. A number of timelines and summaries of mission data are presented in the mission summaries. For Phoenix, a mission overview and dig summary are included. Coordinated Observations—concurrent data collection by the Phoenix, Mars Reconnaissance Orbiter, and Mars Express missions—are listed along with links to the data.

Sol Summaries. The Sol Summaries are the primary interface to integrated data and documents contained within the MER and Phoenix Notebooks (Fig. 1). Data, documents, planned observations, and features are grouped for easy scanning. Detailed information is displayed as items are selected by the user.

Data products are displayed in order of acquisition, and are grouped into logical sequences, such as a series of image data. Sequences and the individual products that comprise them may be viewed in detail, manipulated, and downloaded. Color composites and anaglyph stereo images may be created on demand. Graphs of some non-image data, such as spectra, may be viewed. Data may be downloaded as zip or gzip files, or as multiband ENVI image files.

Mission-specific features are also available in the sol summaries. In the MER Notebook, activity plan listings are interspersed with the resulting products. In the Phoenix Notebook, graphical timelines contain planned observations and links to data products. Locations are identified through use of context images as well as position offset within the lander frame.

Maps. The MER and Apollo Notebooks offer a map interface for locating data. The Apollo Notebook map denotes each station, including sample locations and links to the data. The MER Notebook contains two maps for each rover, one showing the drive traverse, and the other an interactive map showing the location of imaging and Mossbauer products for each site.

Searching. Three types of searching through data and documents are available within the MER Notebooks. Free text searching of data set and sol documents are supported. Data are searchable by instrument, acquisition time, data type, and product ID. Results may be downloaded in a single collection or selected individually for detailed viewing.

Resources. Data set documents and references to published mission papers are contained in the Resources. In addition, links to related web resources are listed.

Online Help. Guidance is provided through a series of searchable help pages. Topics include release notes, mission phases, landing site, coordinate frame, instruments, data processing, and data product file naming and structure.

Future Development: Work continues to incorporate additional Apollo missions within the Analyst's Notebooks framework. In addition, a Notebook is planned for the Mars Science Laboratory mission. For existing Notebooks, planned improvements include better accuracy of maps and easier data download. A number of Notebook functions are based on previous user suggestions, and feedback continues to be sought. (User feedback should be submitted to an@wunder.wustl.edu or to the online user forum.)

Acknowledgement: The Analyst's Notebook is developed through funding provided by the Planetary Data System Geosciences Node, the Mars Exploration Rovers Mission, and the Phoenix Mission. Cooperation of the MER and Phoenix science and operations teams is greatly appreciated.

The Analyst's Notebook is available at http://an.rsl.wustl.edu.

References: [1] Squyres, S.W. et al. (2003) JGR, 108, doi:10.1029/2003JE002121. [1] Smith, P.H. et al. (2008) JGR, 113, doi:10.1029/2008JE003083. [2] Arvidson, R.E. (2008) Phoenix Project Archive Generation, Validation and Transfer Plan, Jet Propulsion Laboratory Document D-29392.

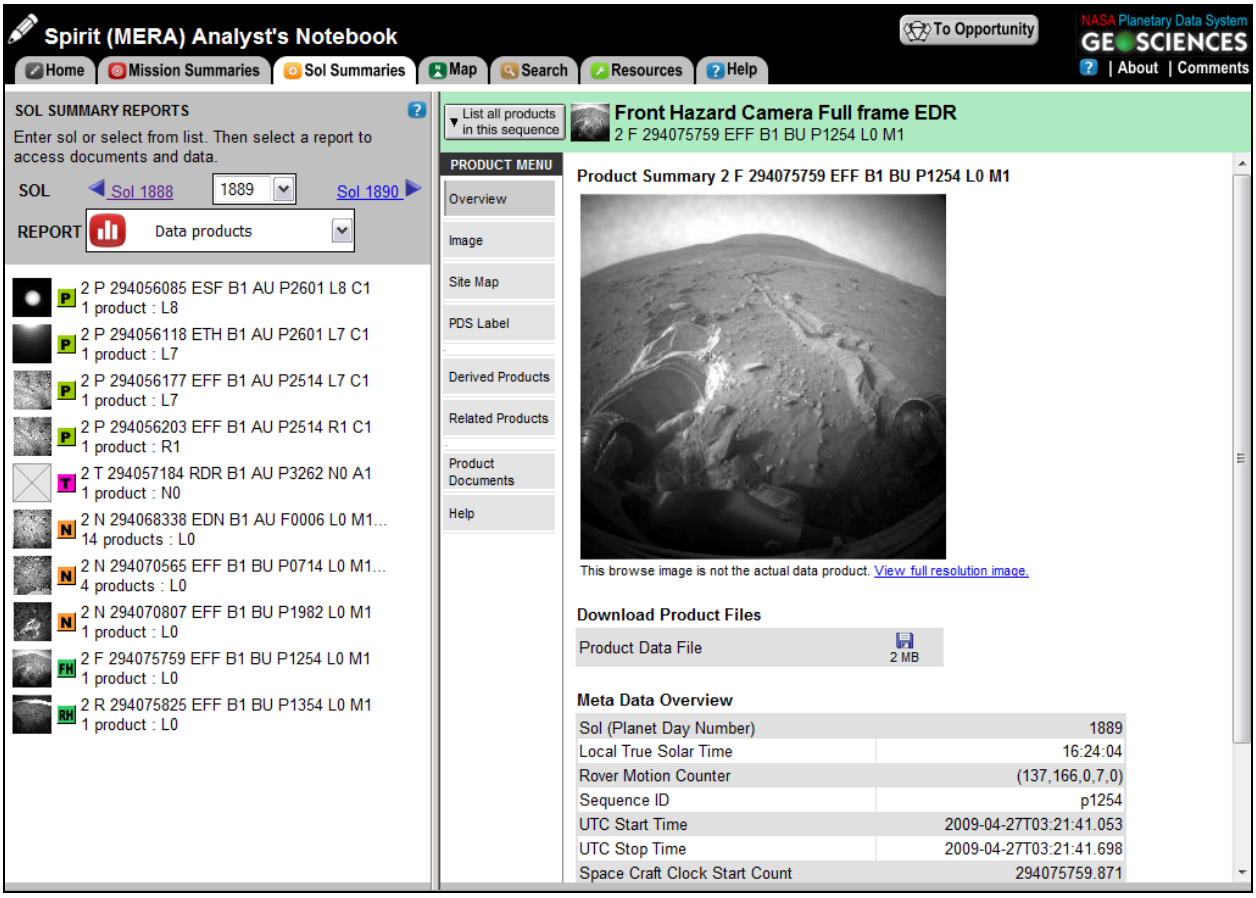

Fig. 1. Example MER Analyst's Notebook Sol Summaries web page.